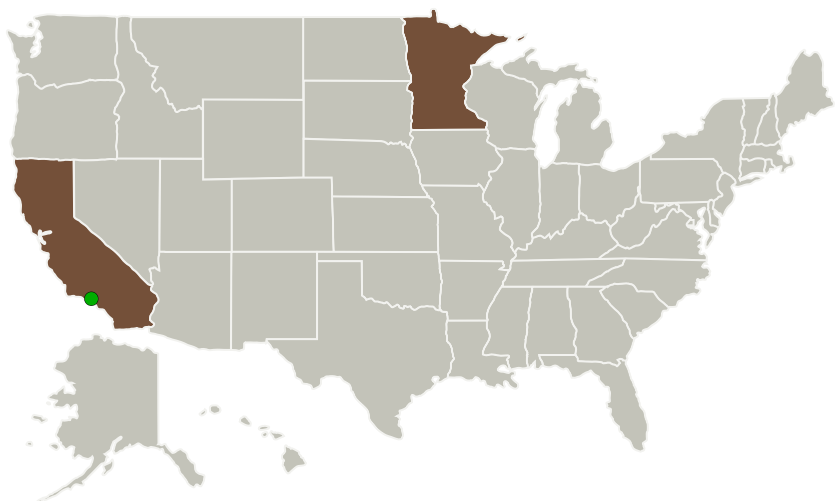
GaN Bulk Growth and Epitaxy from Ca-Ga-N Solutions, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

This SBIR proposal addresses the liquid phase epitaxy (LPE) of gallium nitride (GaN) films using nitrogen-enriched metal solutions. Growth of GaN from solutions offers the possibility of drastically reducing the density of line defects. As these defects adversely affect both breakdown voltages and electron velocities, their reduction can significantly increase the performance of high power Ka-band HEMT structures used for satellite communications. To achieve low defect densities in GaN films and efficient, large scale manufacturing, IIIAN will utilize new chemical growth methods based on nitrogen-enriched metal solutions, in particular the Ca-Ga-N ternary system. In the binary calcium-gallium alloy system it is possible to achieve a nitrogen atomic fraction of 2% at 900 oC and 2 bar. This is a significantly higher fraction than is possible in pure gallium solutions. For example, a temperature of ~1700 oC and pressure of ~10 kbar are necessary to achieve even 0.1% atomic nitrogen fraction in pure gallium solvent.

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
The IIIAN Company, LLC	Lead Organization	Industry	Minneapolis, Minnesota
Jet Propulsion Laboratory(JPL)	Supporting Organization	NASA Center	Pasadena, California

GaN Bulk Growth and Epitaxy from Ca-Ga-N Solutions, Phase I

Table of Contents

Primary U.S. Work Locations	
California	Minnesota

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:
- Final Summary Chart*(https://techport.nasa.gov/file/139971)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

The IIIAN Company, LLC

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Jody J Klaassen

Co-Investigator:

Jody Klaassen

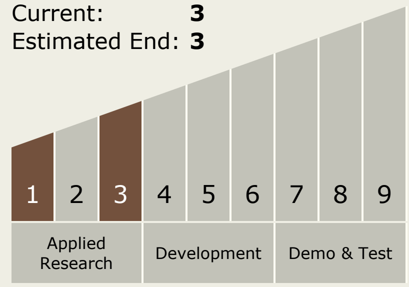
Small Business Innovation Research/Small Business Tech Transfer

GaN Bulk Growth and Epitaxy from Ca-Ga-N Solutions, Phase I

Completed Technology Project (2010 - 2010)

Technology Maturity (TRL)

Start: **1**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX05 Communications, Navigation, and Orbital Debris Tracking and Characterization Systems
  └ TX05.2 Radio Frequency
    └ TX05.2.2 Power-Efficiency

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System